

ARC 300 Metropolis: Towards A Service-Oriented Architecture



**Harry Pierson
architect
Microsoft Architecture
Strategy
Microsoft Corporation**

Outline

- **Metropolis: The Analogy**
- **Understanding SOA with Metropolis**
- **Metropolis As Guidance**
- **Conclusion**

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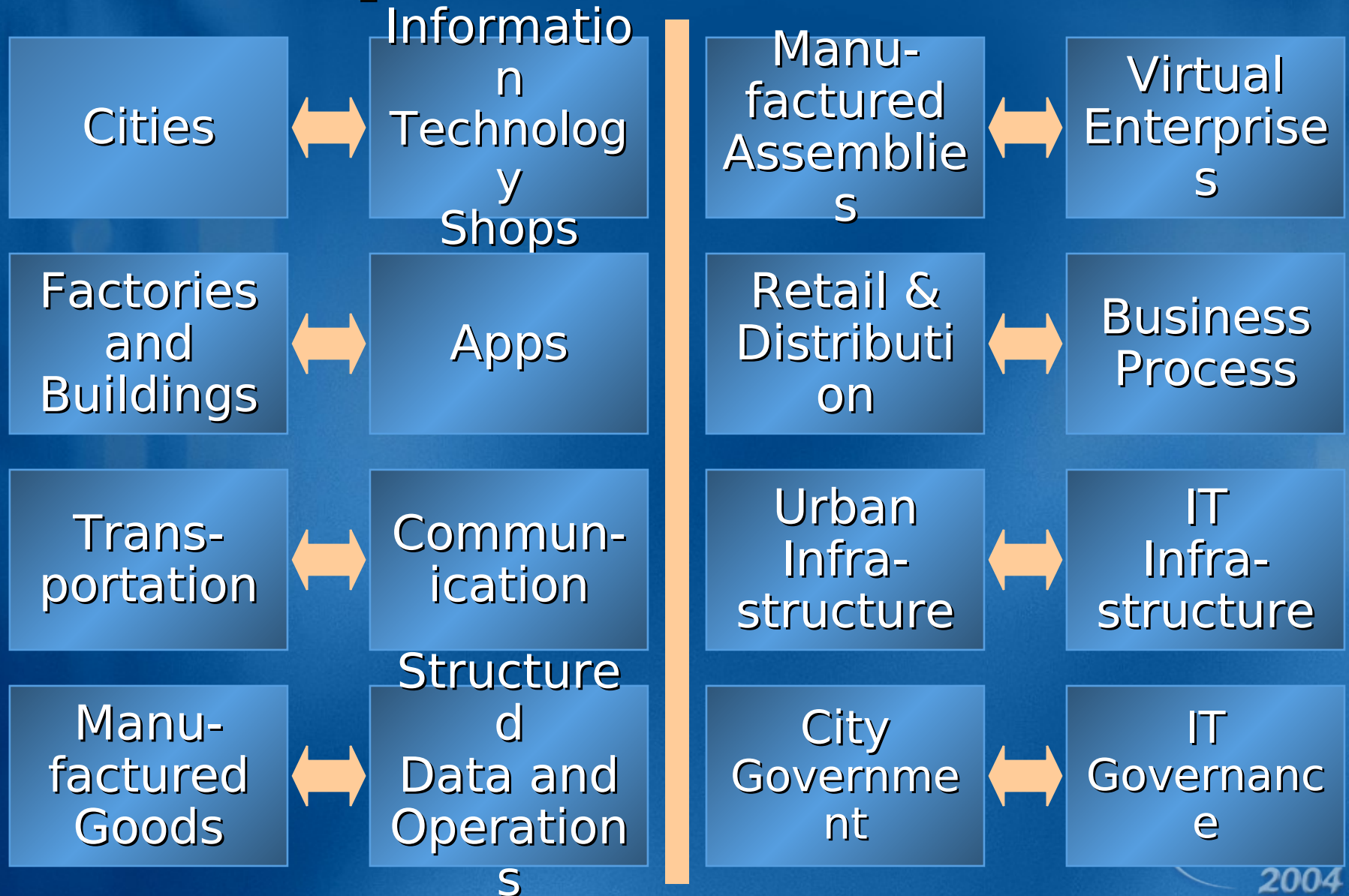
The Metropolis Analogy

- **IT Shops and Cities**
 - Gradual Evolution
 - Developed in Isolation
- **Railroads Arrive**
 - People Travel
 - Stuff Travels
 - Commodity versus Manufactured
- **Internet Arrives**
 - People Browse
 - Data Moves
 - Commodity versus Structure



We propose that
this analogy shows
us a lot about
where
we are heading!

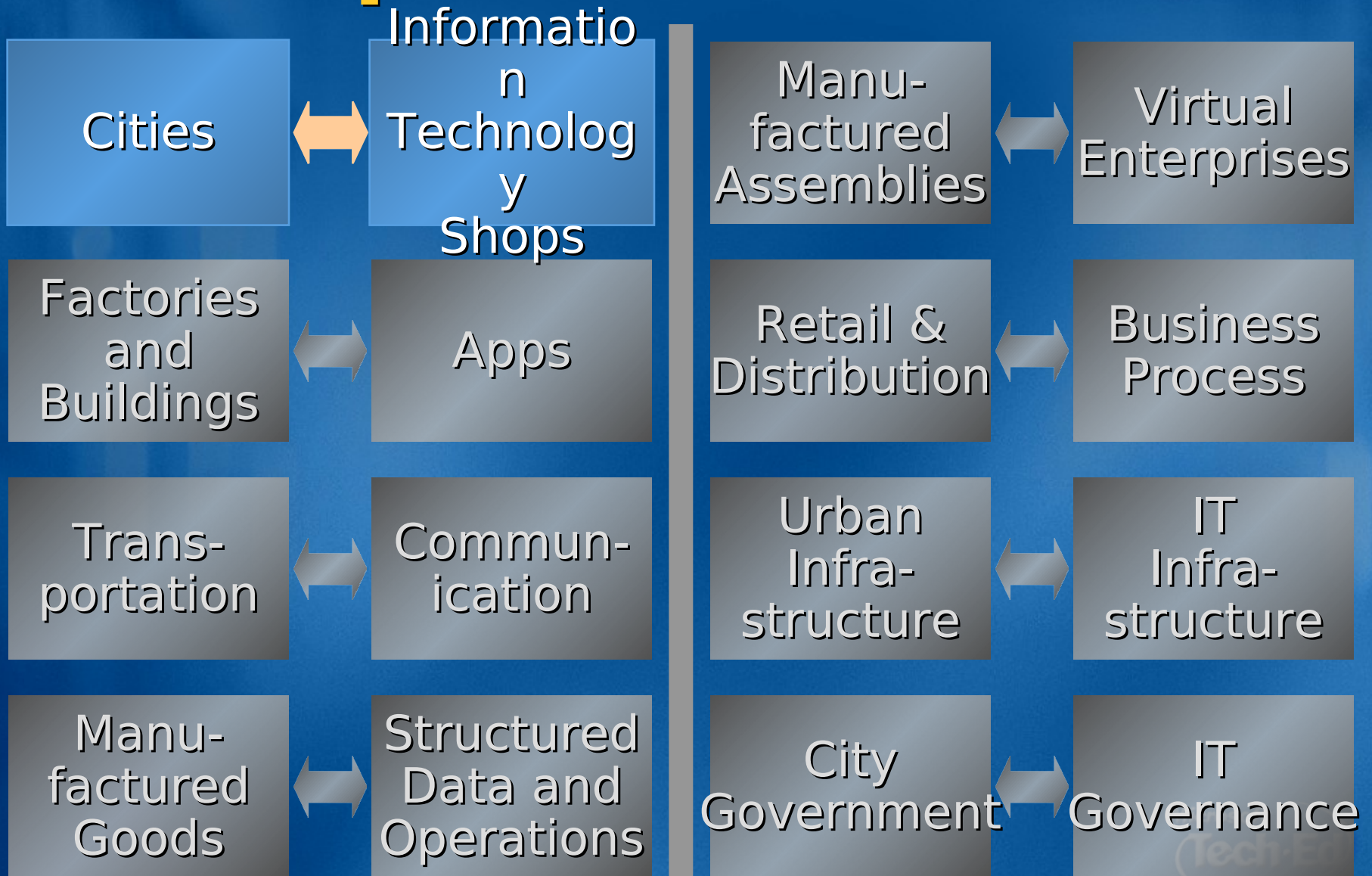
Metropolis



Implications Of Metropolis

- **Heterogeneity Happens!**
- **Ongoing IT Investment**
 - Infrastructure versus Business
 - Historic Monuments
- **Standardization Is Nascent**
 - Connection Largely by People
 - Efficiencies Still to Come
- **Business Process Is Nascent**
 - Still Mostly Ad-hoc
 - Growing to Become Dominant Force
- **Loose Coupling Helps Investments**

Metropolis



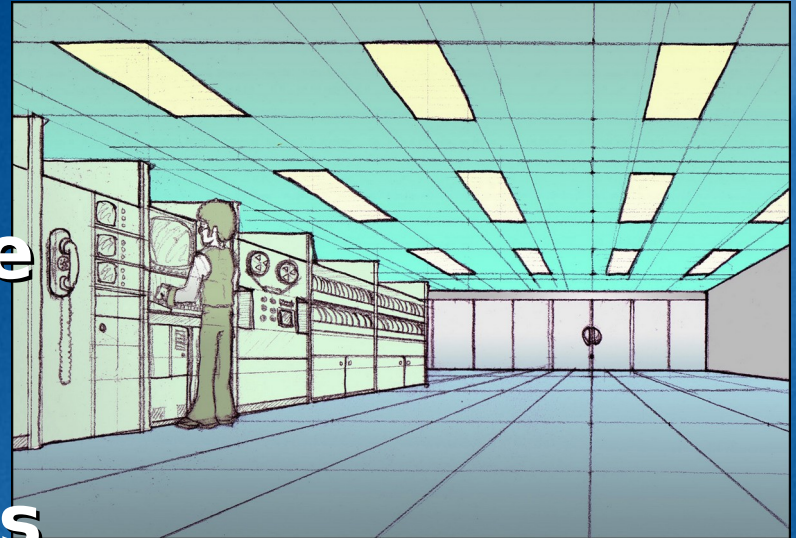
The Evolution Of Cities

- **Gradual Growth**
 - Gather for Commerce and Manufacturing
- **Independent Buildings**
 - No Connections
- **Independent Cities**
 - Travel Too Hard
 - Cities Did Things Their Own Way



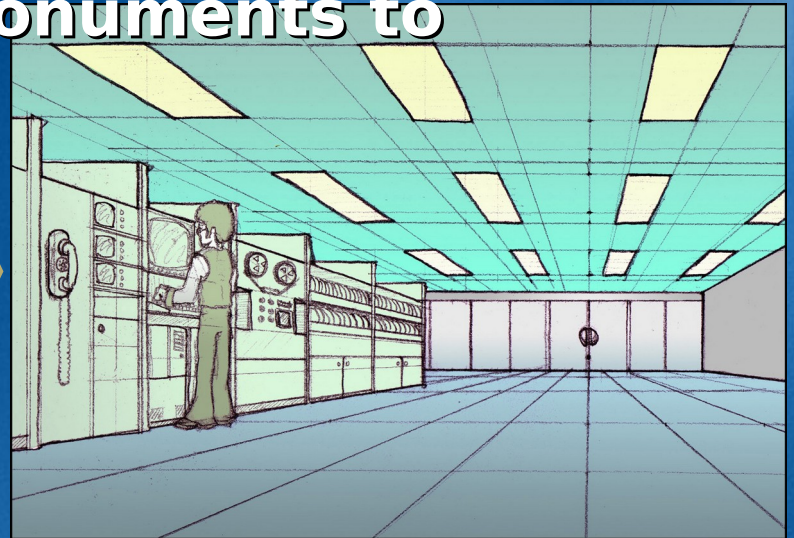
The Evolution Of The IT Shop

- Gradual Growth
 - New Apps Gradually Built
- Applications Largely Independent
 - People Interact Separately with Apps
- B2B Still Limited
 - Largely via People
 - Independently Designed and Incompatible Apps



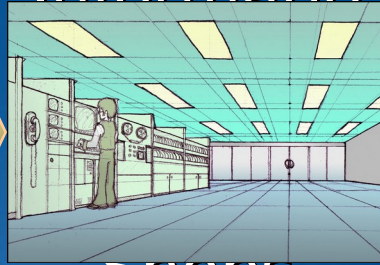
Cities And IT Shops

- **Big Complex and Evolving Environments**
 - Fed by Economics
 - Ongoing Investment
 - New and Renovated Buildings (or Apps)
 - Infrastructure for Connectivity
- **Both Have Historic Monuments to Consider!**



Metropolis

Information



Shops

Factories
and
Buildings

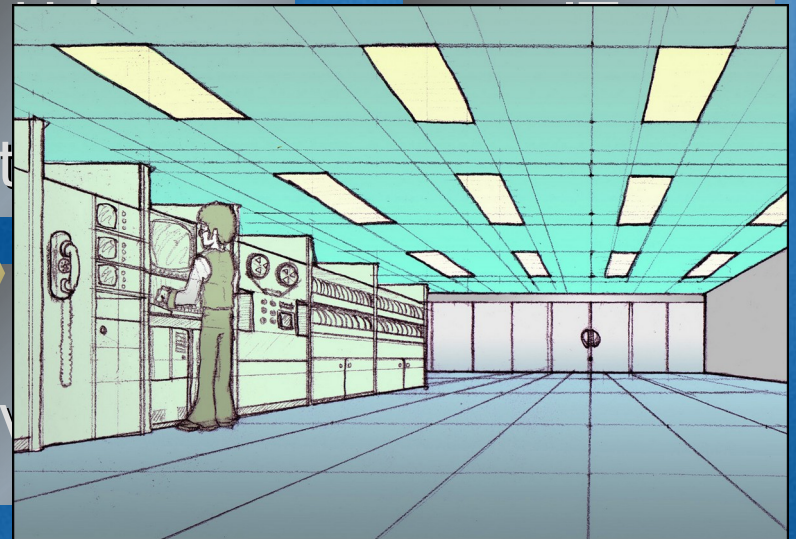
Apps

Manu-
factured
Assemblies

Virtual
Enterprises

Retail &
Distribution

Business
Process



Gov

Factories And Buildings

- **Early 1800s**
 - Independent Structures
 - Shipping Difficult
 - Many Different Types of Structures
 - Housing, Barns, Churches, Town Halls, Inns, Simple Manufacturing
- **Late 1800s**
 - Autonomous Yet Interconnected
 - Located by Railroads
 - Stuff Efficiently Flows Between Buildings
 - City Infrastructure
 - Even More Types
 - High-Density Housing, Sophisticated Factories, Offices, Retail, Train Stations
 - Economy Based on Flow of Stuff



Applications

- **Today**

- **Independent Applications**

- Raw Communication (Shipping Bytes) Easy
- Understanding Structured Data and Operations Hard

- **Many Different Types of Apps**

- On-Line Transaction Processing, Web-Based, Scientific, CAD, Client-Server, Games

- **Tomorrow**

- **Autonomous Yet Interconnected**

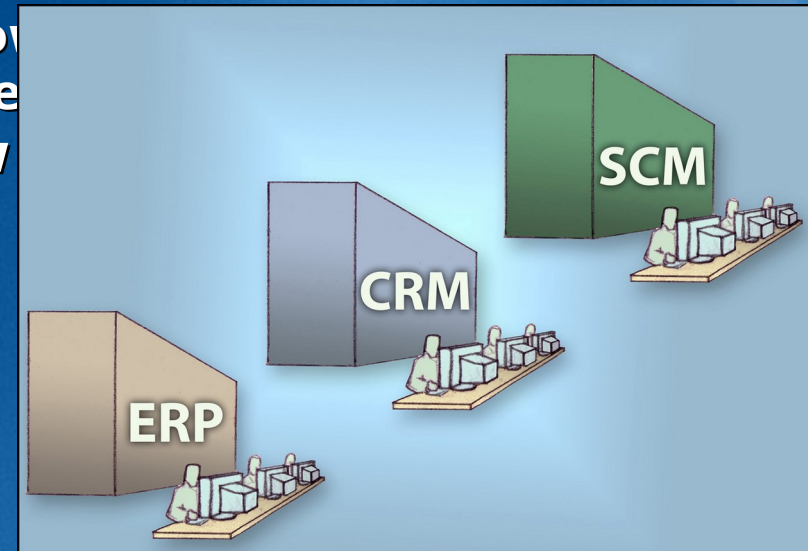
- Structured Data and Ops Flow
- Tapped into IT Infrastructure

- **Economy Based on the Flow of Structured Data and Ops**

- No App Is an Island

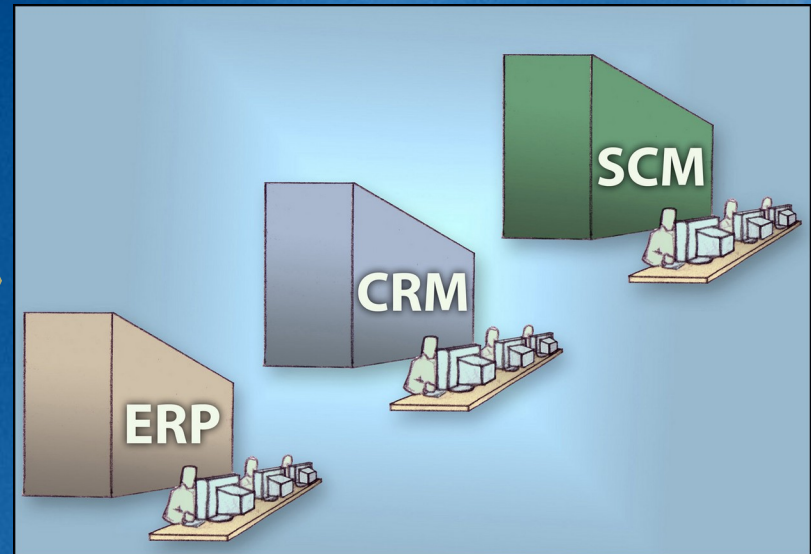
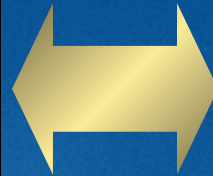
- **New Types of Apps?**

- All the Old Types Change to Become Interconnected

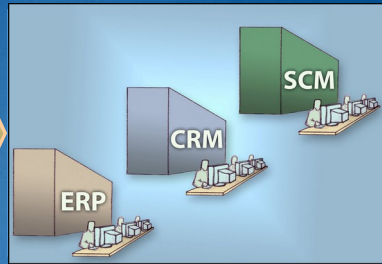
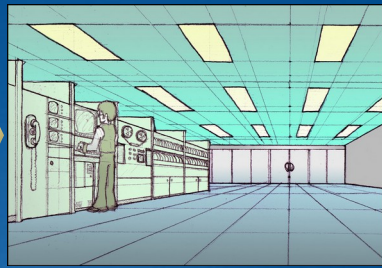


Factories And Apps

- **Independence Is Essential**
 - Get Work Done
 - Decoupled Evolution
- **Advantages to Interconnection**
 - Leverage Others
 - Economy Based on Flow of Stuff (Data and Ops)
- **Tap Into Infrastructure**
 - Services from City or IT-Shop



Metropolis



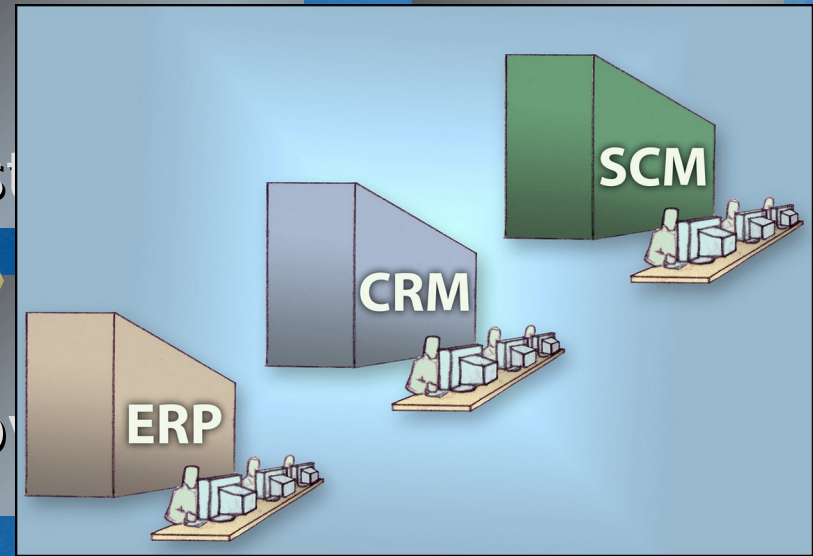
Manu-
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Assemblies

Virtual
Enterprises

Retail &
Distribution

Business
Process

Gov



Transportation

- **Railroad Arrives!**
 - Money Moving People and Raw Commodities
 - Speculations, Booms, and Busts...
- **Movement of People Changed Things**
 - Retail Expanded
- **Movement of Stuff Changed Things**
 - Stuff Had to Work Together
 - Retailers Could Gather Stuff for Sale

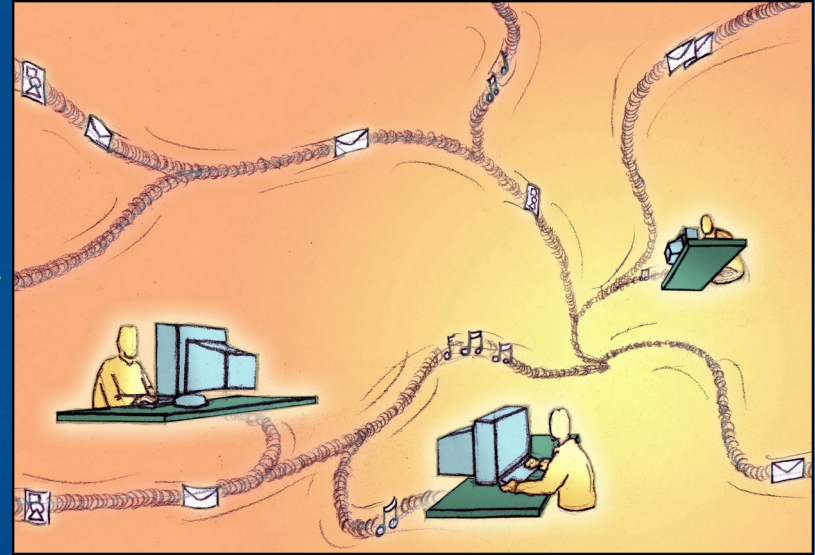
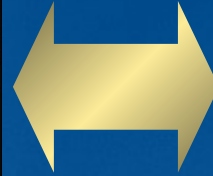
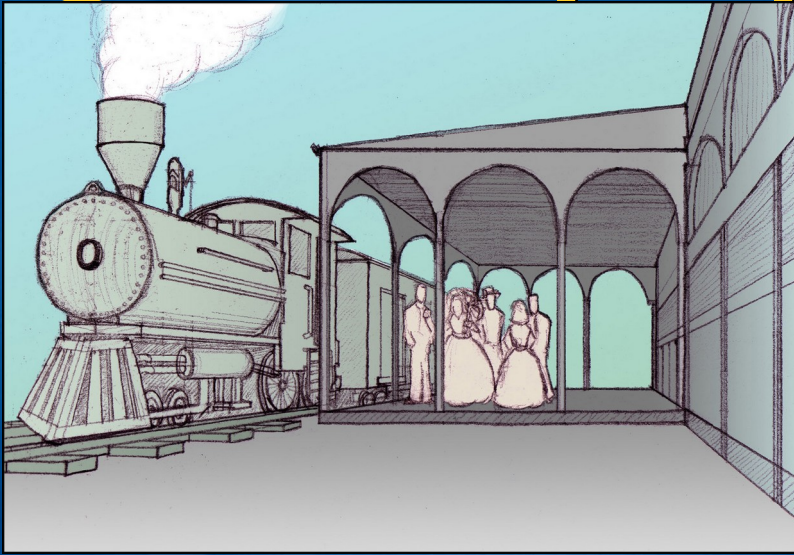


Communication

- **Internet Arrives!**
 - Money In Browsing & Moving Raw Data
 - Speculations, Booms, & Busts...
- **People Browsing Changed Things**
 - Directly Access Remote Apps
 - Driving Demand for Business Process
- **Changes from Movement of Data Nascent**
 - Data Still Doesn't Work Together
 - Business Process Still Very Limited

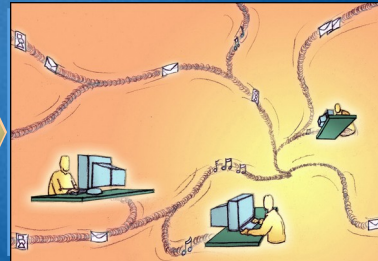
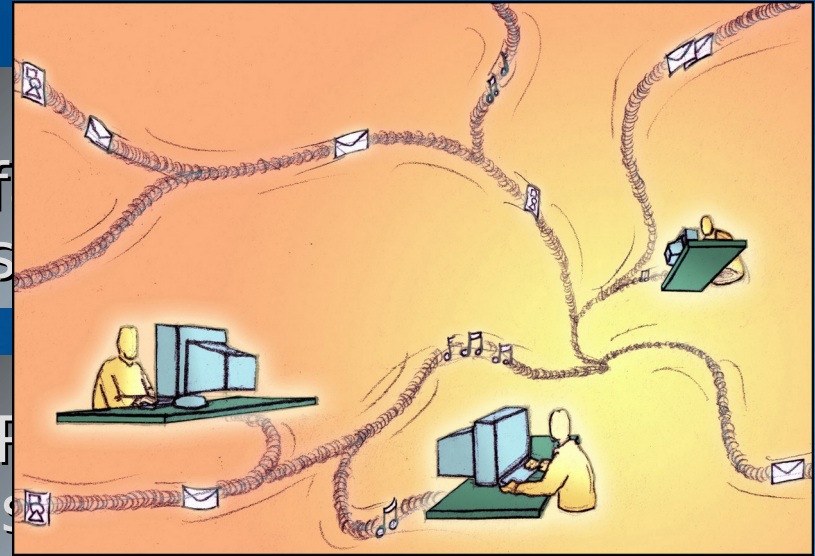
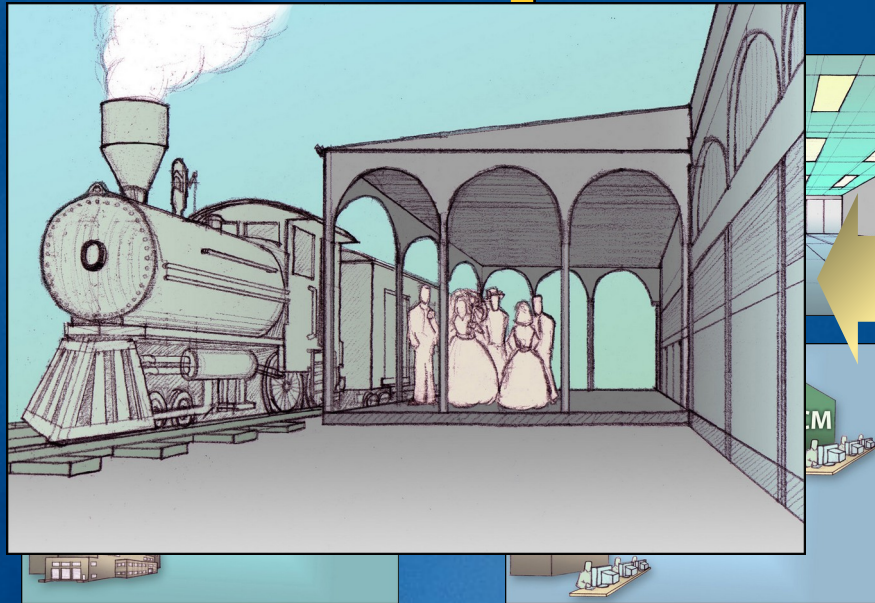


Transportation And Information



- **Started Moving People and Commodities**
- **Drove New Changes**
 - **Standardization**
 - **Stuff and Data**
 - **Retail and Business Process**
 - **Economic Consolidation**
 - **Cities**
 - **IT-Shops Using Structured Data**

Metropolis



Structure
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Data and
Operation
s

Manu-
factured
Goods

Urban
Infra-
structure

IT
Infra-
structure

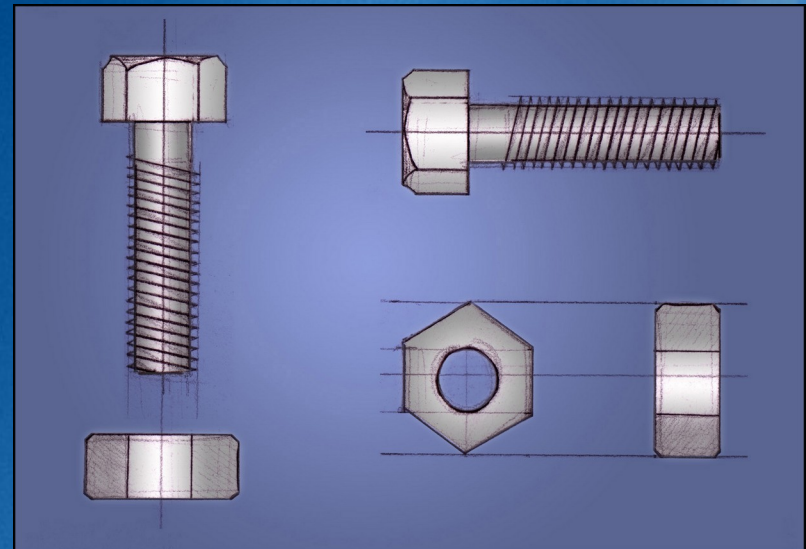
City
Government

IT
Governance

Manufactured Goods

- **Early 1800s**
 - Hand-crafted Goods
 - “Trim-and-Shim”
 - Eli Whitney - Interchangeable Parts
- **Late 1800s**
 - De Facto Standards Per Industry
 - Marketplace Demanded Compatibility
 - Retailing Demanded Compatibility
- **Retooled or Went Under!**

See “Eli Whitney”
by Constance McL. Green
Addison Wesley Longman 1956



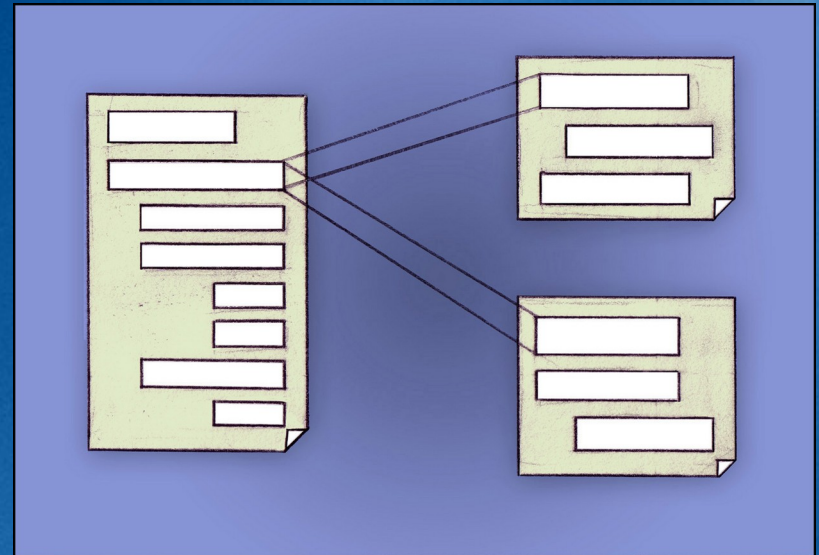
Structured Data And Operations

- **Today**

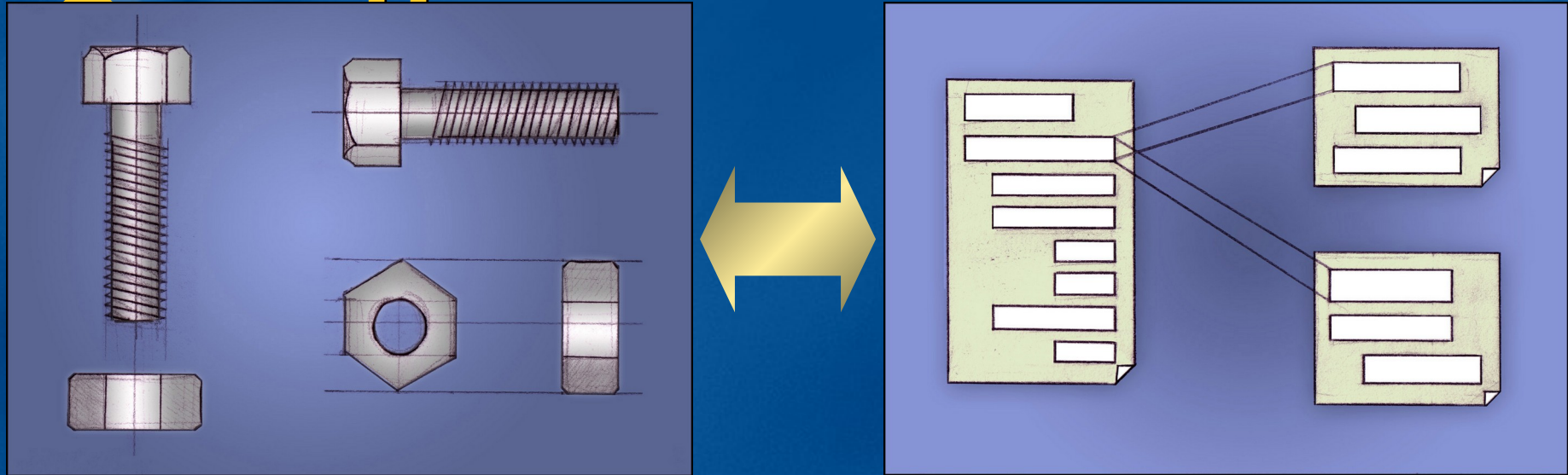
- Non-Standard Data Structures and Operations
- Mostly Human “Trim-and-Shim” to Integrate
- Beginnings of Standardization
 - Web Services Foundation
 - Need Industry Standards
 - Demand for Business Process

- **Soon**

- Industry De Facto Standards
- Increased Compatibility
- More Sophisticated Business Process

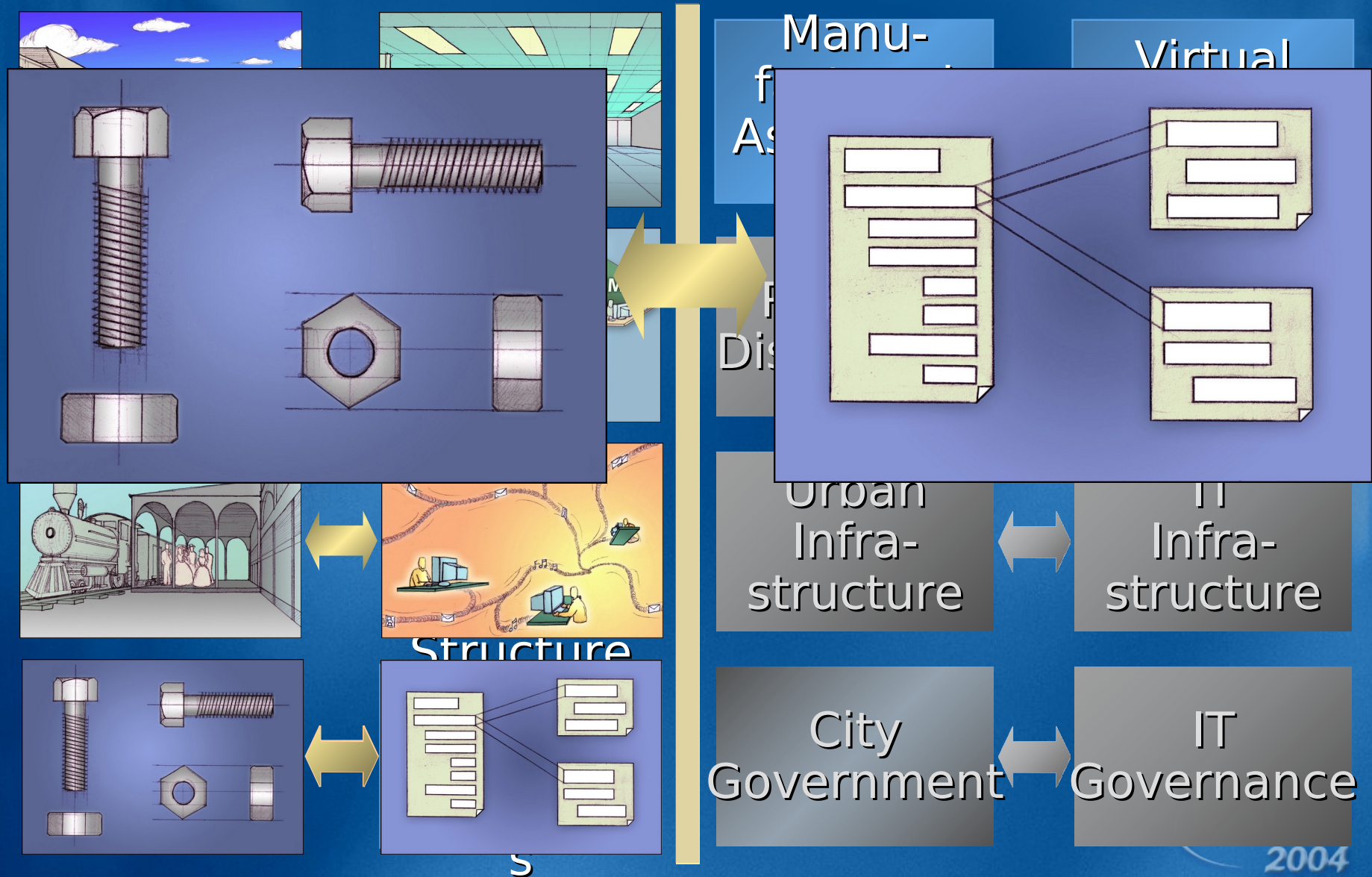


Manufactured Goods And Structured Data And



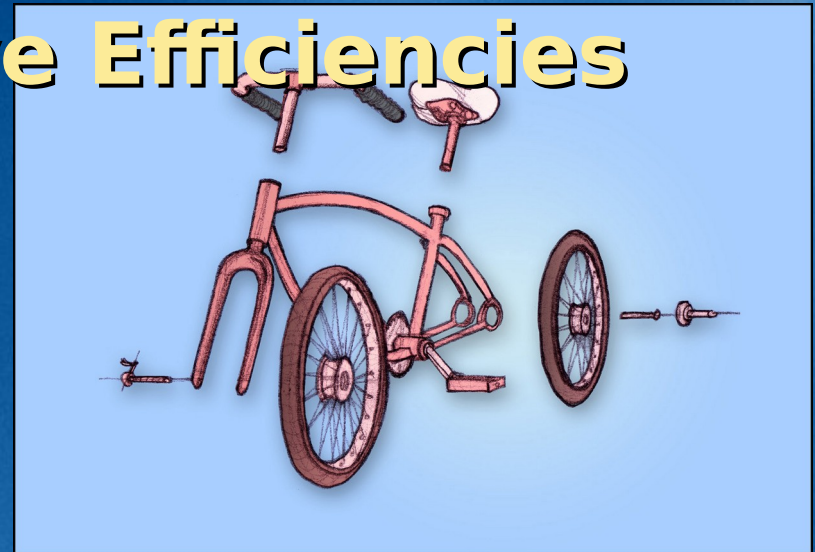
- **Must Connect to Other Stuff**
 - Can't Live in Isolation
 - Manufacturing Retooled
 - New Efficiencies and Markets Came
 - Applications Must Retool
 - Data and Business Process Integration
 - Tremendous Payoffs to Come

Metropolis



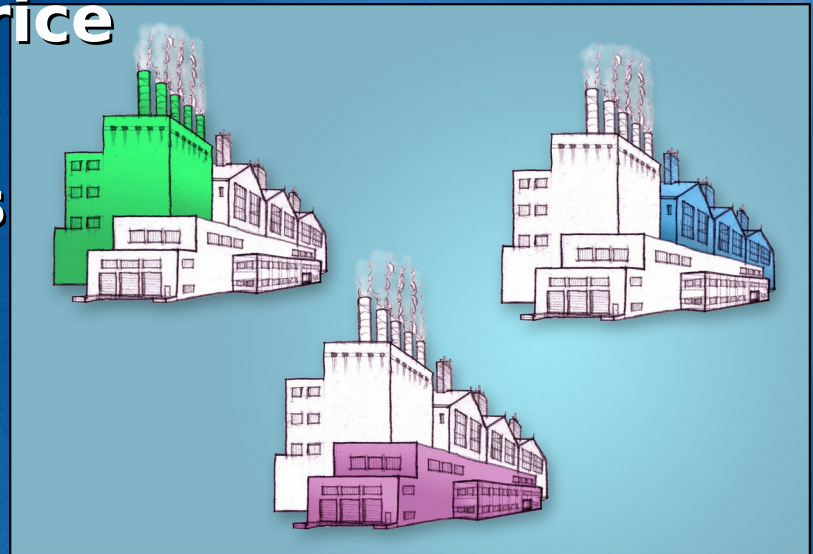
Manufactured Assemblies

- Assemble Parts from Other Factories
 - Requires Detailed Standardization
 - Produces High-Value Goods
 - Leverage Other Companies' Stuff
- Competition Drove Efficiencies
 - Better Parts
 - Better Prices



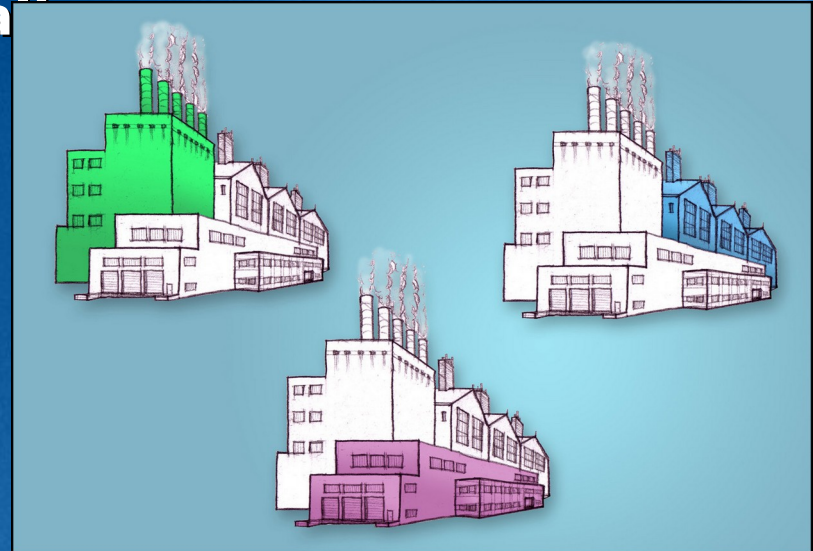
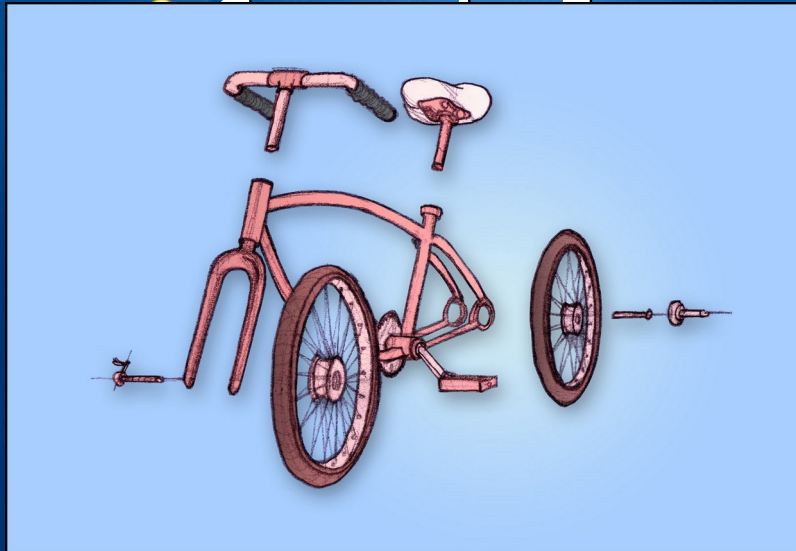
Virtual Enterprises

- **Business Function Outsourcing**
 - Acquire Business Functionality Outside
 - Produce More Sophisticated Business Value
 - Concentrate on Your Center of Excellence
- **Competition Drives Efficiencies**
 - Better Quality and Price
- **Requires Standards**
 - Data and Biz-Process

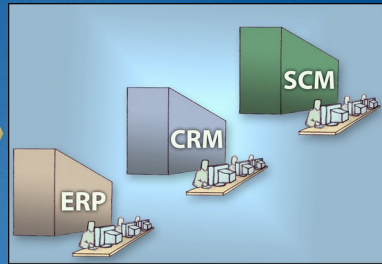
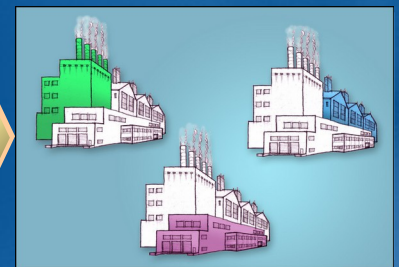
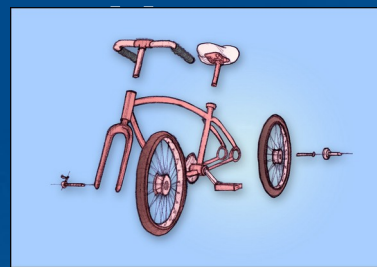
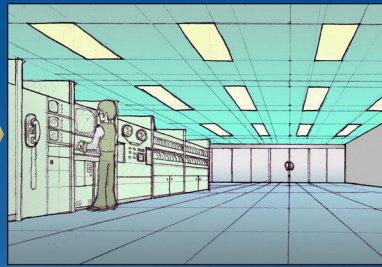


Manufactured Assemblies And Virtual Enterprises

- Standards Allow Composable Stuff (Data and Ops)
- Better Stuff (Data and Ops) is Created
 - Combining Efforts of Many Companies
- Increased Efficiencies
 - Lower Prices or Greater Profitability

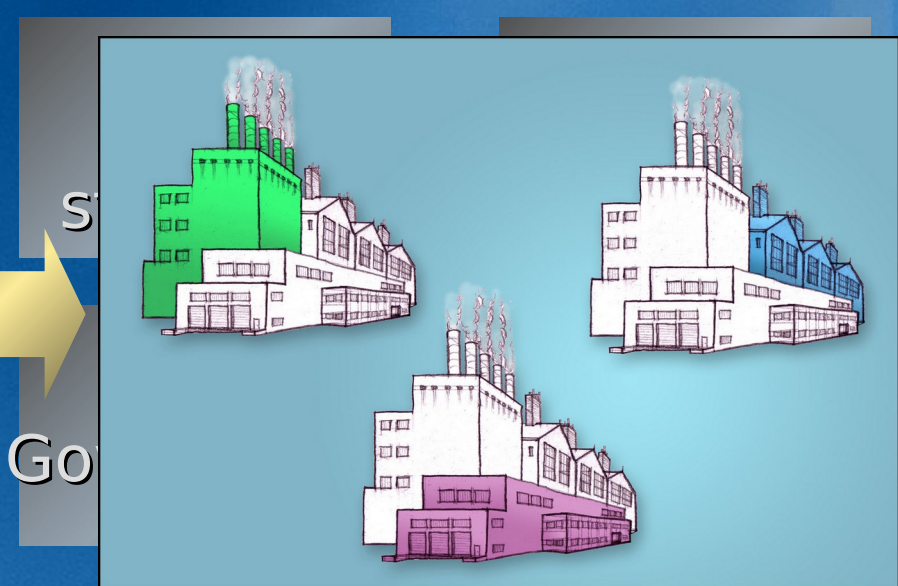
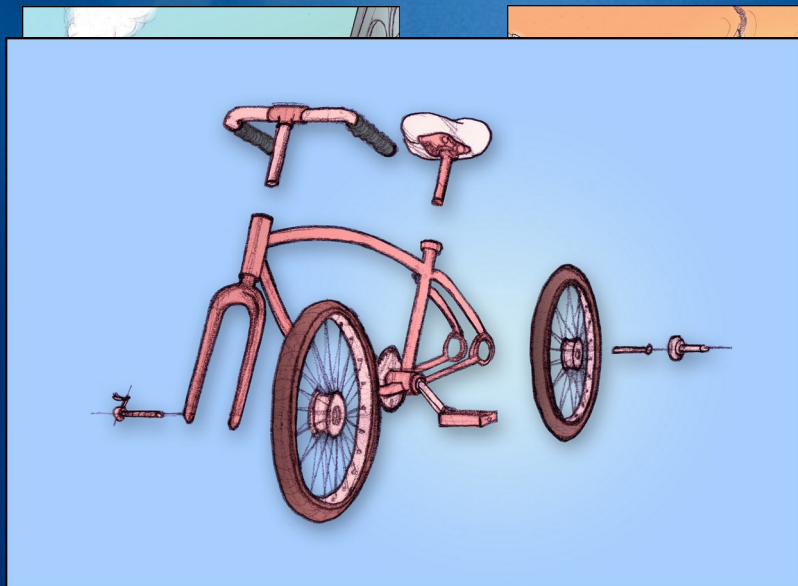


Metropolis



Retail &
Distributio
n

Business
Process



Retail And Distribution

- **Late 19th Century**

- **Bring People to Stores**
 - Trains Brought Shoppers
- **Bring Standardized Stuff to Stores**
 - Department Stores Emerge
- **Send Standardized Stuff to People**
 - Mail Order

- **20th Century**

- **Department Stores and Supermarkets**
- **Wal-Mart**
 - Shift in Power to the Retailer!



Business Process

- **Today:**

Swivel-Chair
Integration

Excellent for EAI across apps

FAX and Pray
Integration

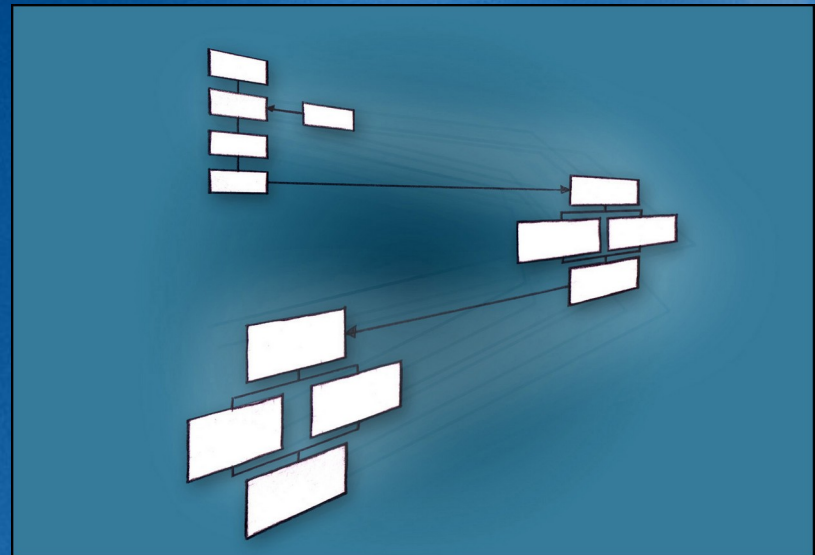
Most common form of B2B work

ALT-TAB Integration

Reduces errors via the clipboard

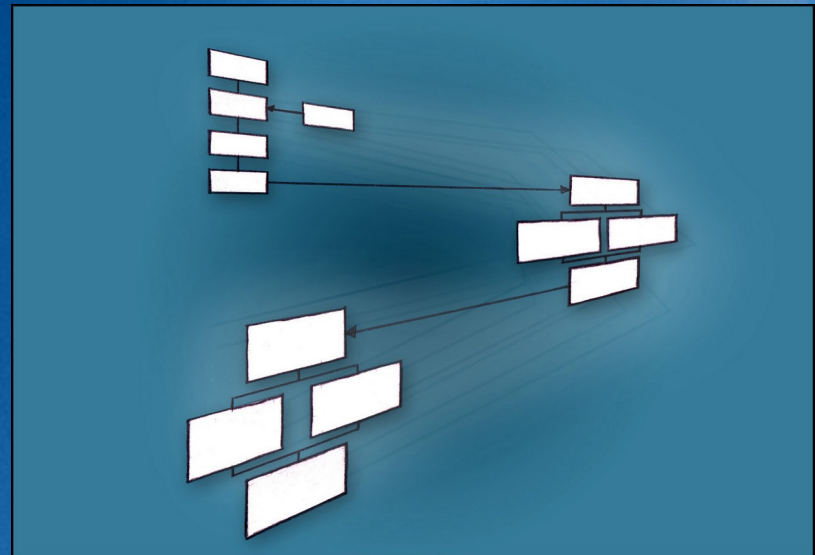
- **Looking Ahead:**

- **Data and Operation Standards**
- **Need “Interchangeability”**
 - Standardized Clothes Sizes
 - Not as Specific and Detailed
- **Allows Pre-allocation**
- **Makes Biz Process Efficient**

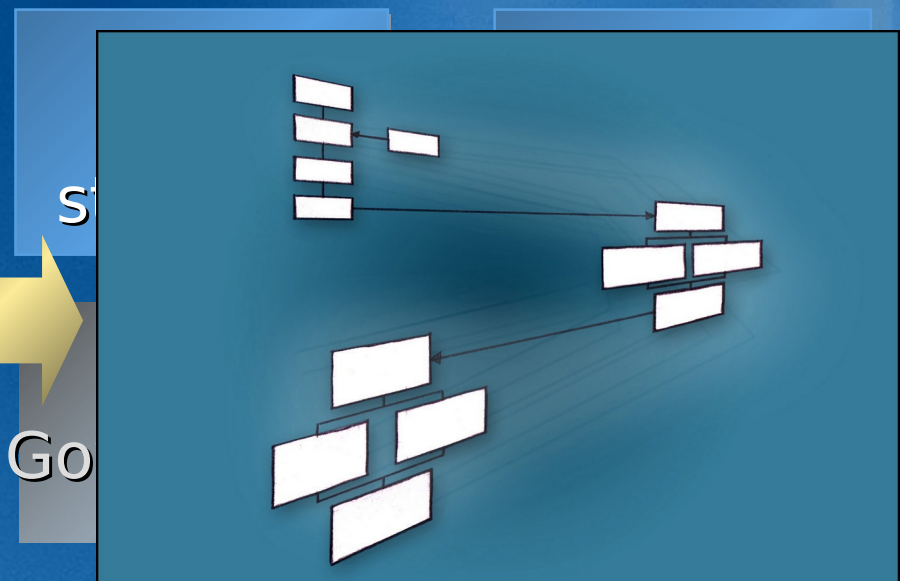
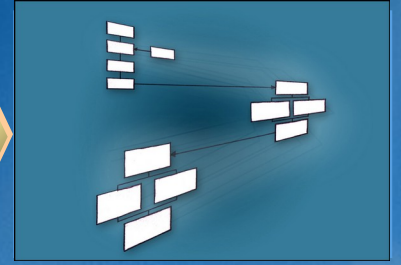
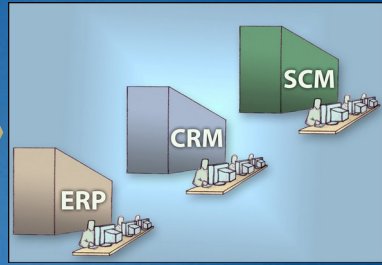
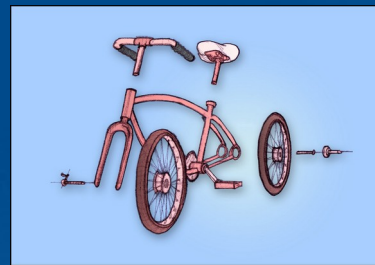
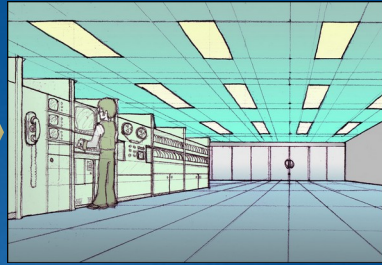


Retail And Business Process

- **Amazing Transformation in Retail**
 - People Cheerfully Accept Standard Stuff
 - Customization Is Rare and Expensive
- **Business Process Mostly Hand-Crafted**
 - Poor Standards; Manual “Trim and Shim”
 - Poor “Interchangeability”
- **Business Process Will Grow to Drive the**



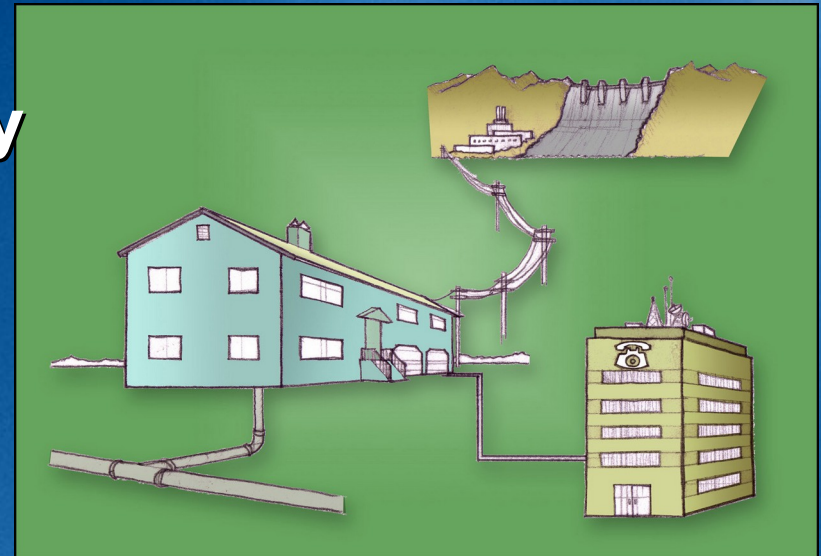
Metropolis



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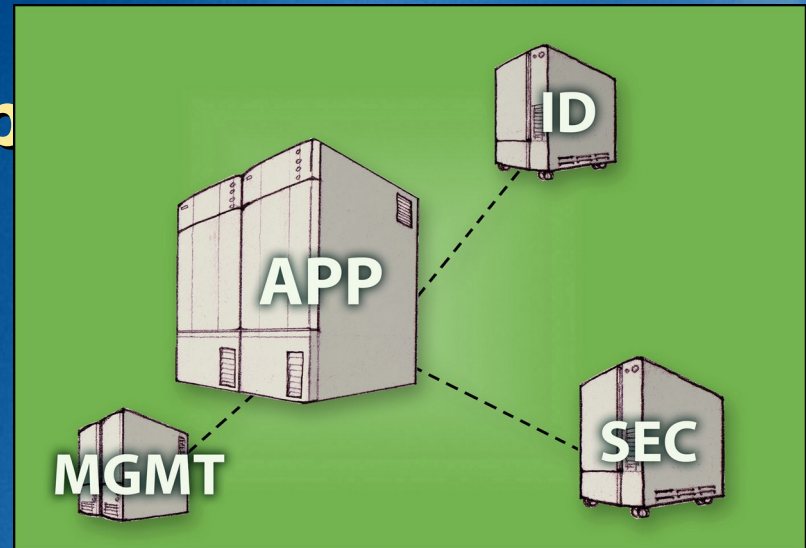
Urban Infrastructure

- **Urban Density → Urban Infrastructure**
 - Water, Sewer, Gas, Electricity, Broadband...
- **Requires Metropolitan Support**
- **Requires Local Hookups**
- **Retrofit Happens**
 - Notre Dame has Toilets and Electricity
 - Conduits for Future
- **Funding**
 - Sometimes Private
 - Sometimes Public

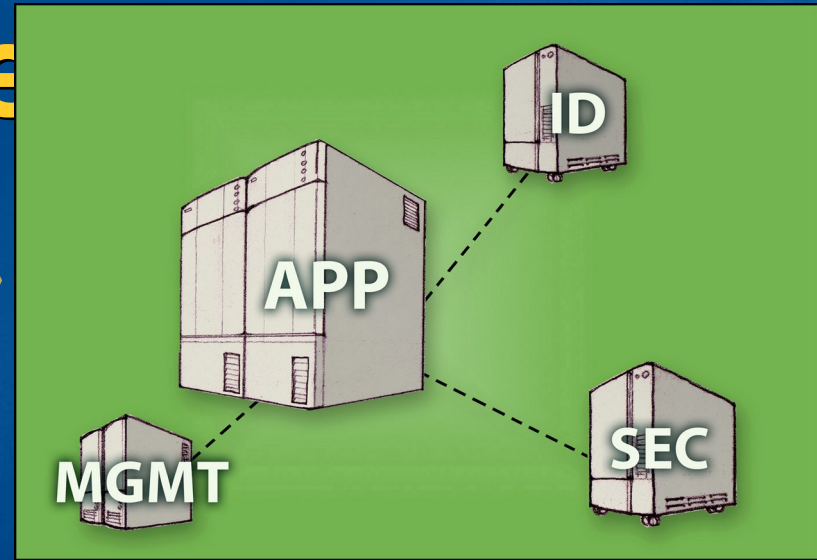
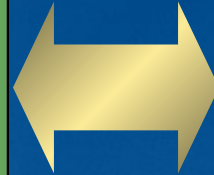
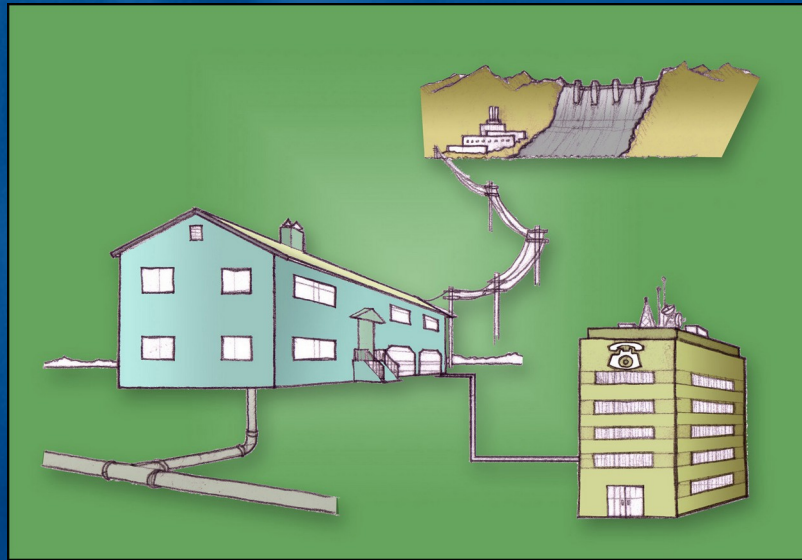


IT Infrastructure

- Many Apps & Servers → IT Infrastructure
 - Easier with Single Mainframe
- Federated Infrastructure:
 - Identity, Security, Naming and Directory, etc.
- Requires IT Services
- Requires App Hookup
- Retrofit Happens
 - Web Services Offer Hope to Ease Retrofit
- Funding Competes with Apps

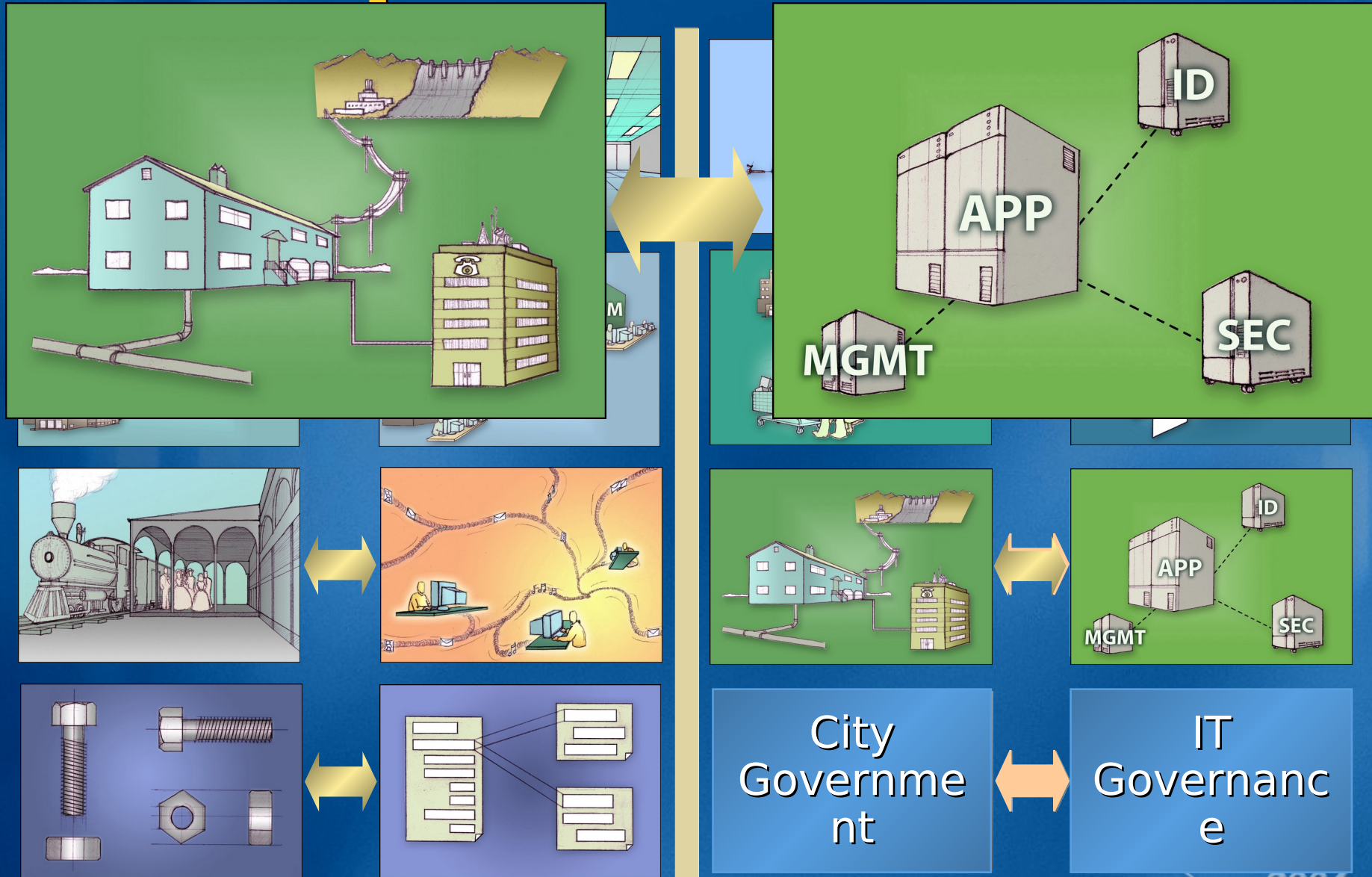


Urban And IT Infrastructure



- **Infrastructure for Crowded Environments**
 - Needs Supporting Services
 - Needs Hookup to Buildings or Apps
- **Retrofit Happens**
 - May Be Biggest Cost
 - Design for Future Extensions
- **Funding Competition**

Metropolis



City And IT Decisions

City Vision

IT Principles

City Planning

IT Architecture

City
Infrastructure
Goals

IT Infrastructure
Strategy

Factory/Building
Investments

Business
Application
Needs

Private/Public
Investment
Choices

IT Investment
and Prioritization

Source for IT Decisions:

“Don’t Just Lead, Govern! Governing IT for Different Performance Goal”

**Professor Peter Weill, CISR, MIT Sloan School of Management;
June 2003**

City Government

- **Decisions for Allocating Resources**
 - City and Business Leaders
 - Infrastructure Usually Needs Cooperation
- **Factories/Buildings Usually Business Driven**
 - Cities Usually Constrain and Control
- **Manufactured Goods Controlled by Business**
 - Cities Have Little Say...

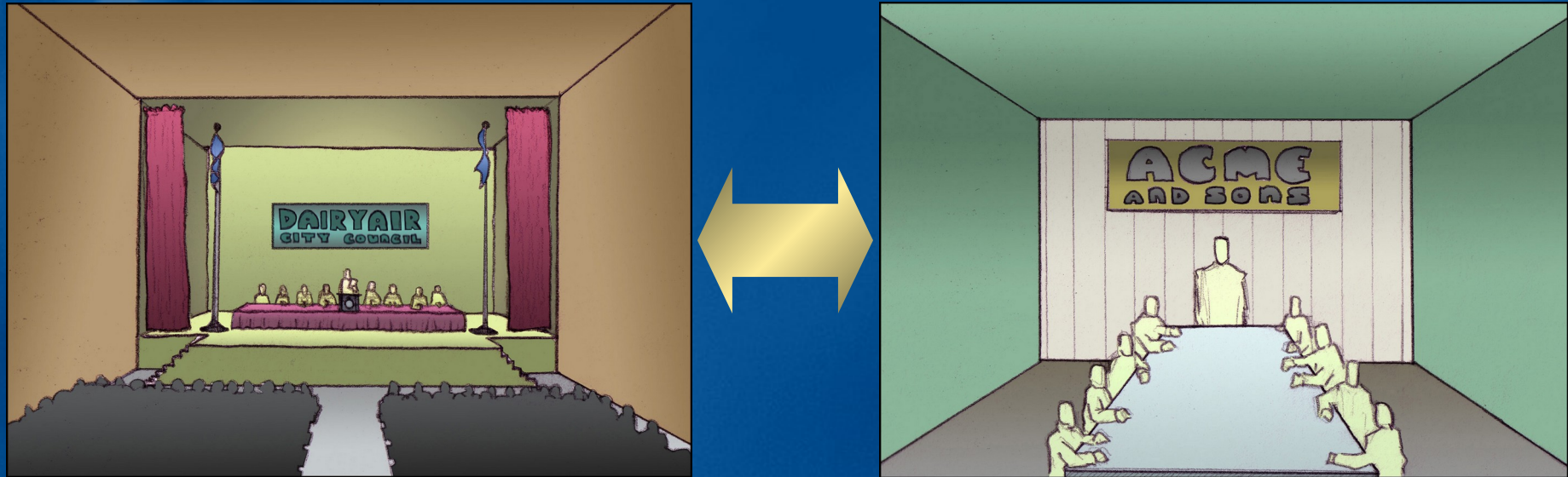


IT Governance

- **Who Makes Decisions?**
 - CEO? CIO? Business Unit Execs? Techies? Committees?
- **What Are Priorities?**
 - Asset Utilization? Cost? Flexibility? Growth?
- **Metrics**
 - What is Success?
 - Who Is Accountable?
- **What Are Our Goals?**
 - Reduce Cost?
 - Better Information?
 - Competitive Advantage?



City Government And IT Governance



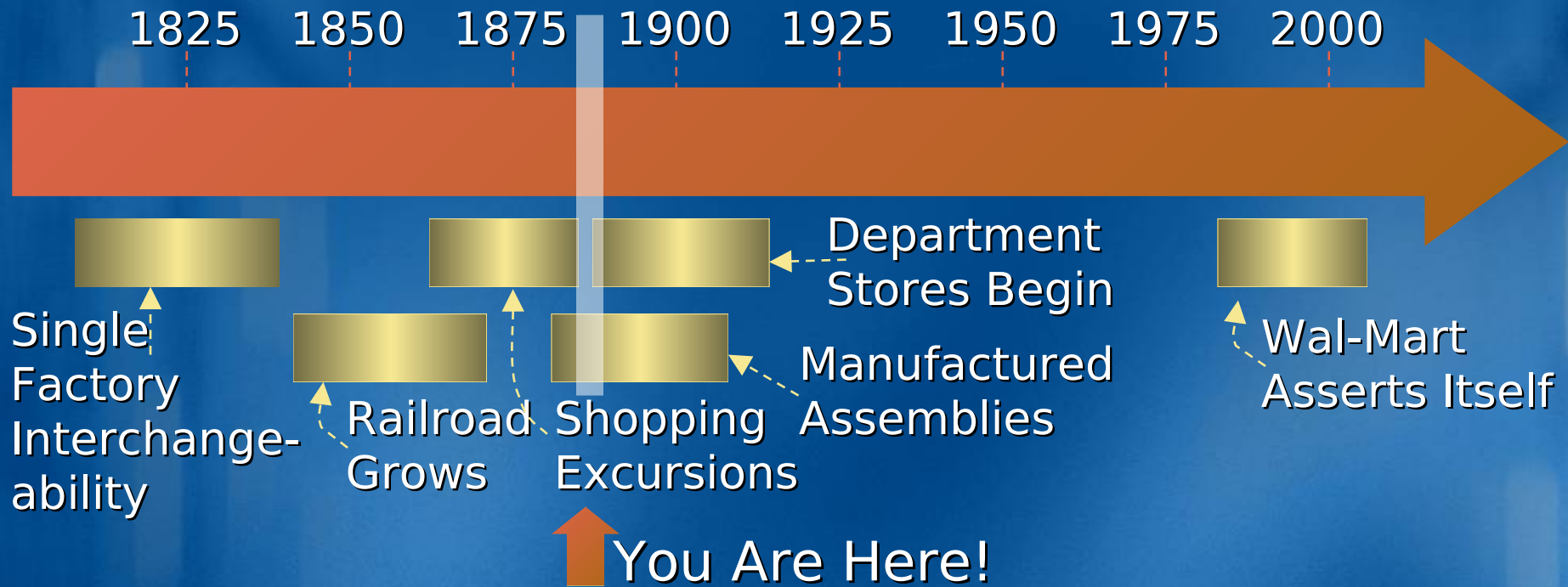
- **Similar Decisions Problems for Cities and IT-Shops**
 - Cities Provide Inspiration
- **Cities (Usually) Optimize for Growth**
 - Businesses Drive Building/Factory Investment

See: "Don't Just Lead, Govern! Governing IT for Different Performance Goal", IBID

Metropolis



Looking To The Future



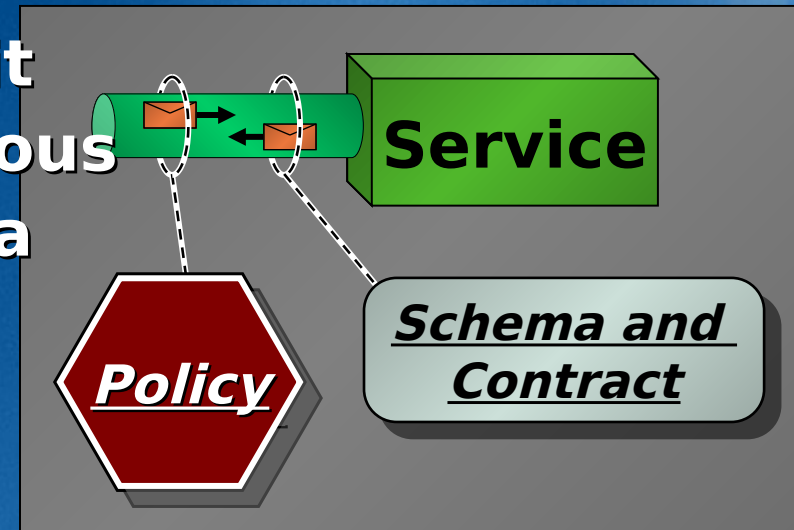
- **Equivalent to 1880 or so...**
 - Communication and Browsing Well Established
 - Virtual Enterprises Getting Going
 - Business Process a Gleam in Our Eye
- **Lots of Fun Ahead of Us**
 - Biz-Process Won't Take as Long as Retail Did to Mature

Outline

- **Metropolis: The Analogy**
- **Understanding SOA with Metropolis**
- **Metropolis As Guidance**
- **Conclusion**

Service-Oriented Architecture

- **Service-Orientation**
 - Independent Services
 - Chunks of Code and Data
 - Interconnected via Messaging
- **Four Basic Tenets:**
 - Boundaries Are Explicit
 - Services Are Autonomous
 - Services Share Schema and Contract
 - Not Implementation
 - Service Compatibility Is Based on Policy



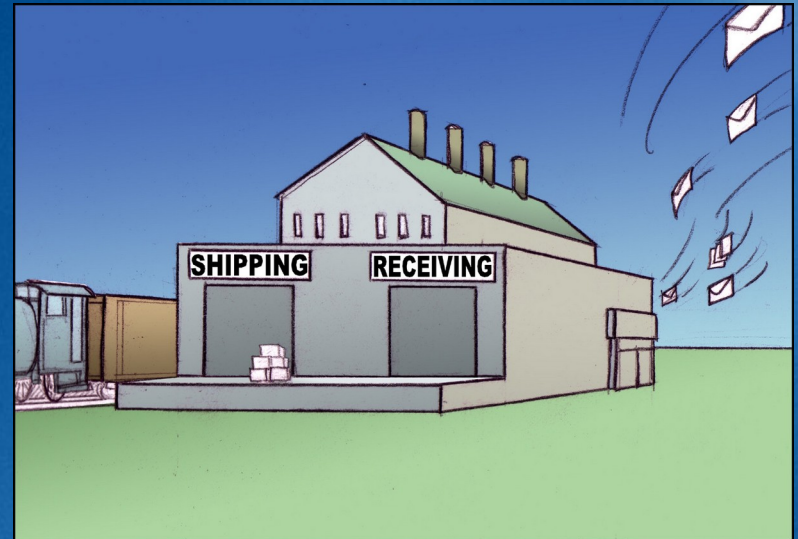
A Look At Today's Apps

- **People Walk in the Front Door**
 - Perhaps Buy Standard Stuff
 - Frequently Do Customized Operations
- **Work Is Usually Done “While You Wait”**
 - This Is Synchronous and Specialized Processing
 - How Manufacturing Was Done Before Eli Whitney!
- **Difficult to Do Mass Production**
 - Standards Rare
 - Efficiencies Are Difficult
- **Not Service-Oriented!**
 - Silos, not Services
 - Rarely Interact Together
 - Muddled Resource Mgmt and Business Process



The Mail-Order Business

- **A Mail-Order Business is Asynchronous**
 - Work Requests Arrive in Bags of Mail
 - Product Arrives in Shipments
- **Each Message (Order) Is a Transaction**
 - Goods Are Prepared and Packed
 - Payment Is Processed
 - Stuff is Shipped
- **Standards and Interchangeability Required**
 - Both Goods and Forms
- **Mail-Order Is a Service-Oriented Architecture!**
 - Autonomous
 - Explicit Boundaries
 - Interaction via Forms
 - Explicit Policies for Work



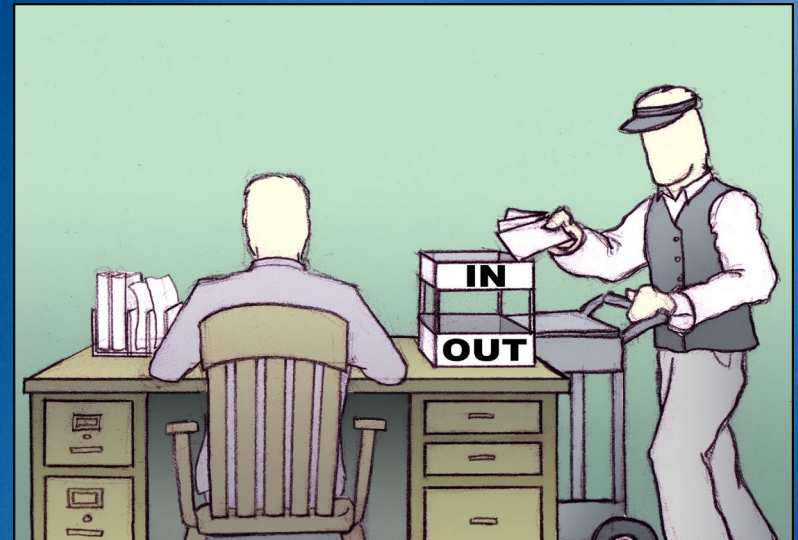
A Visit From The Salesperson

- **Sales-People Arrive with Catalogs and Forms**
 - Catalogs Are Needed to Fill Out Forms
 - Filling Out Forms Doesn't Need Factory Access
- **Sales-People Make It Easy**
 - They May Represent Multiple Factories
 - They May Help Deliver and Get Started Using Stuff
- **Smart Clients Are Like Sales-People**
 - They Make It Easy
 - They Work Offline
 - They Accept Orders and Provide Results
 - Perhaps Multiple Apps



Watching A Business Grow

- **Small Businesses Are Intimate**
 - Everybody Knows What's Going On
 - Process and Data Are Shared By Everyone
- **Big Businesses Formalize Process**
 - Cross-Department Work Requires Forms
 - Everything Gets Documented and Recorded
- **Composite Business Services**
 - One Company's Work
 - Implemented As Separate Departments
 - Formal Interfaces
 - Separate Records
 - Asynchronous Processing
 - Looks Like One Company



Three Reasons For Using Services

- **Autonomy of Applications**
 - Independent Development and Evolution
 - Clarifies Encapsulation and Privacy of Data
- **Separation of Biz-Process and App**
 - Allow Separate Development of Biz-Process
 - Apps Gravitate to Managing Resources
- **Enabling IT Infrastructure**
 - Surround the App (Service) in Predictable Way
 - Connect the App (Service) into IT Infrastructure

***These Changes
Empower New
Business Models!***

Three Categories Of Service Use

- **Building New Solutions With Services**
 - Independent Pieces Within Apps
 - Independent Development and Maintenance
 - Scale-Out
- **Cleaving Together Existing Apps**
 - Connectivity
 - B2B: Business-to-Business
 - EAI: Enterprise Application Integration
 - Business Process
 - Tap Into IT Infrastructure
- **Cleaving Apart Existing Apps**
 - Disentangling the “Big Ball of Mud”

See “Big Ball of Mud” by Brian Foote and Joseph Yoder

Department of Computer Science
University of Illinois, Urbana-Champaign

Schema, Contracts, And Standardization

- **Schema and Contracts Define Behavior**
 - Messages and Sequences
 - Specify How to Interact with a Service
- **De facto Standards Will Emerge**
 - Both Horizontal and Vertical
 - Driven by Market Leader
- **Standards Eliminate Semantic Chaos**
 - Applications Adopt Semantics or

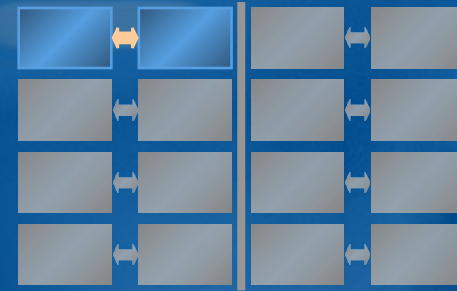
XML Is Like Cardboard

- **Cardboard Protects Stuff When It Is Shipped**
 - It Is Very Malleable
 - Many Different Shapes and Forms
 - It Is Self-Describing
 - The Outside Is Labeled
 - The Inside Has Instructions
- **XML Surrounds and Protects Data and Ops**
 - It Is Malleable and Self-Describing
- **Cardboard Is One of the World's Largest Industries**
 - Almost Everything Gets Shipped in Cardboard
 - Started Around 1880...
- **Sometimes the Cardboard Weighs More than the Stuff Being Protected...**

Outline

- **Metropolis: The Analogy**
- **Using Metropolis to Understand SOA**
- **Metropolis As Guidance**
- **Conclusion**

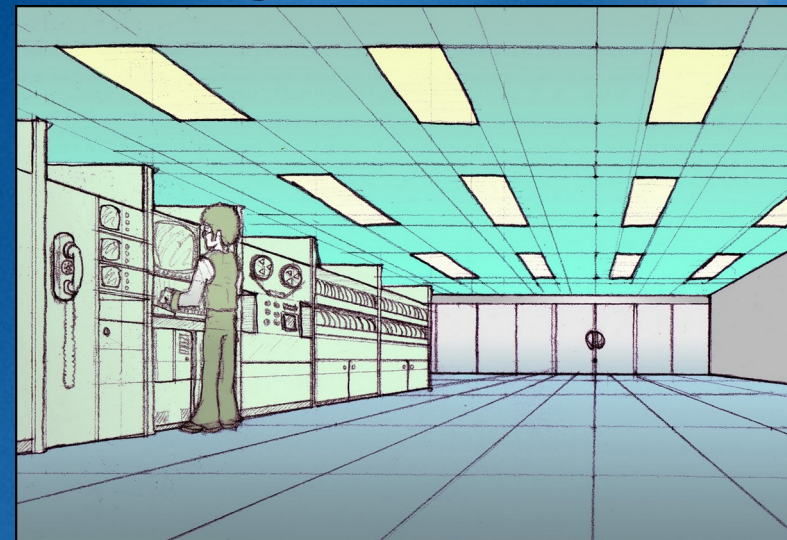
The New IT Shop



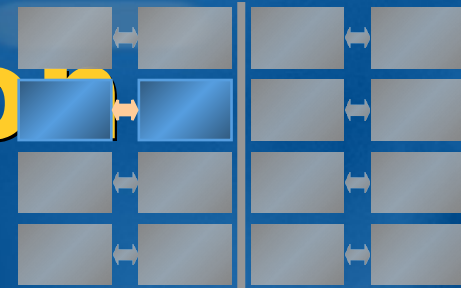
- **Cities versus Towns**
 - In Cities, Most People You Meet Are Strangers
 - Requires Mechanisms to Manage Trust of Strangers
- **IT Shops Will Get More Connected**
 - Connected to Apps (Services) in the Shop
 - Connected to Other Businesses
- **Work Spreads Across Services**
 - Some Services Surround Resources
 - Some Provide Biz-Process
- **IT Infrastructure Hooks the Services Together**
- **IT Governance**
 - Helped by Independence of Services

See: “The Death and Life of Great American Cities” by Jane Jacobs, Vintage Books 1961

See: “Passage to Union: How the Railroads Transformed American Life, 1829-1929” by Sarah H. Gordon, Elephant Paperbacks 1997



The New Application



- **Remodeling Your Application:**

- **Cleaving Apart**

- Remodeling to Add Interior Partitions
- Allows for Efficiencies in Space Management
- Separate Spaces Sometimes Work Better

- **Cleaving Together**

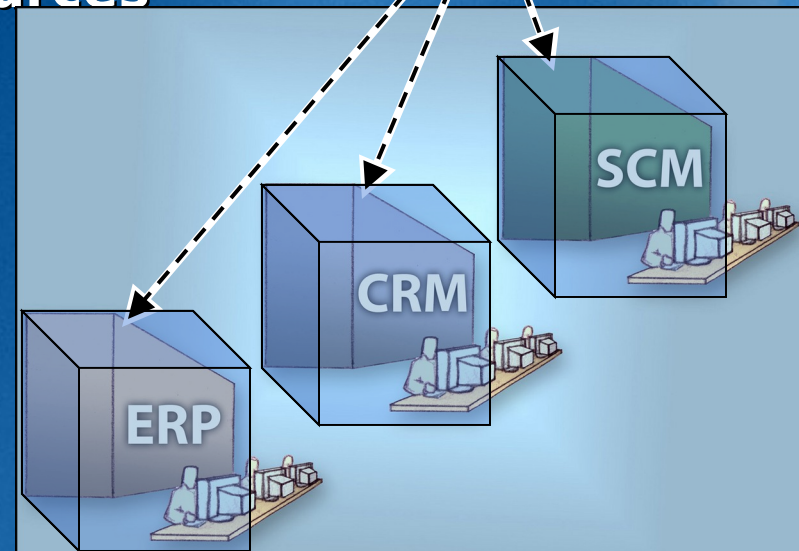
- Busting a Door Through a Wall
- Connection Provides Efficiencies

- **Apps Will Comprise Services**

- **Some Services Control Resources**
 - Analogous to Manufacturing
- **Others Will Focus on Biz-Process**
 - Analogous to Retail
- **Smart Clients Are Like Salespeople**

Apps Become Services

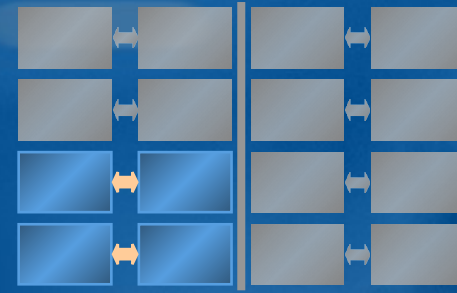
Either by original design
or remodeling...



See: "How Buildings Learn
What Happens After They're
Built?"

by Stewart Brand, Penguin Books
1994

Communication And Structured Data And Ops



- **Sharing Structured Data and Operations**

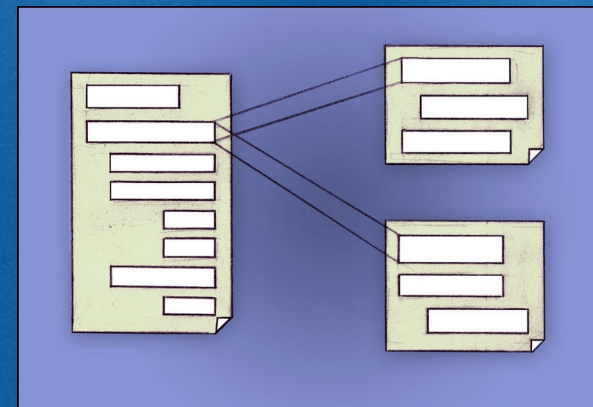
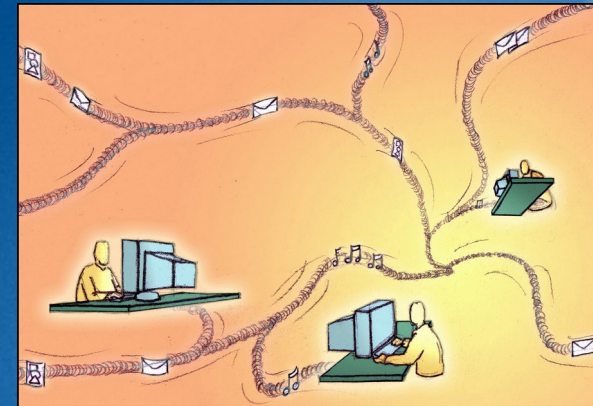
- Immense Pain at First
- Standards Will Emerge
 - Vertical and Horizontal

- **Semantic Differences Get Eliminated Over Time**

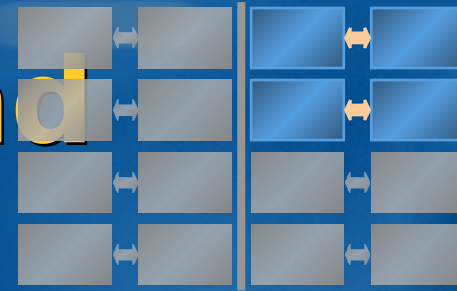
- Sometimes Killing Apps Due to Incompatibility

- **Services Empower This**

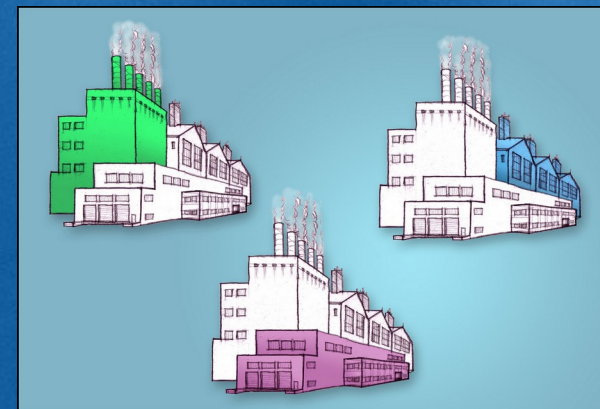
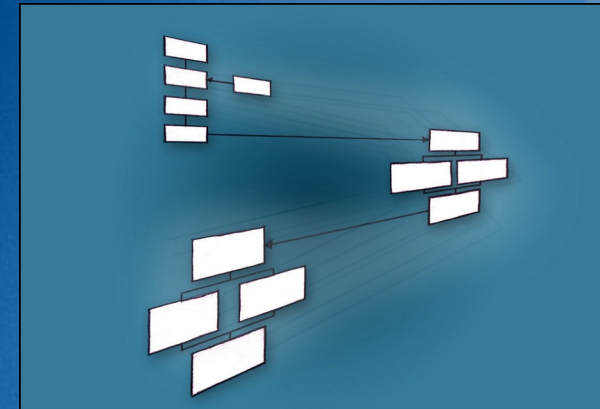
- Difference Between Inside and Outside the Service



Business Process And Virtual Enterprises

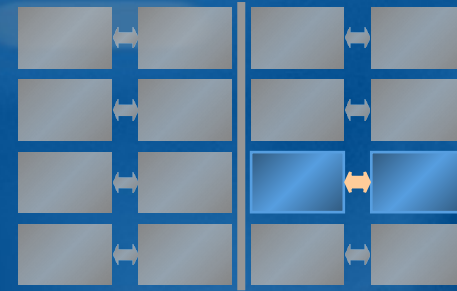


- **Business Process Will Grow Distinct and Strong**
 - Today, Apps Are a Mixture of Resource Management and Biz-Process
- **Soon, They Will Separate**
 - Manufacturing and Retail Grew Apart
- **Biz-Process Will Dominate**
 - It Will Drive the Energy and Money
 - As Biz-Process Crosses Companies It Becomes “Virtual Enterprises”
 - Corporate Boundaries Blur
- **Tremendous Efficiencies and Economic Benefit**

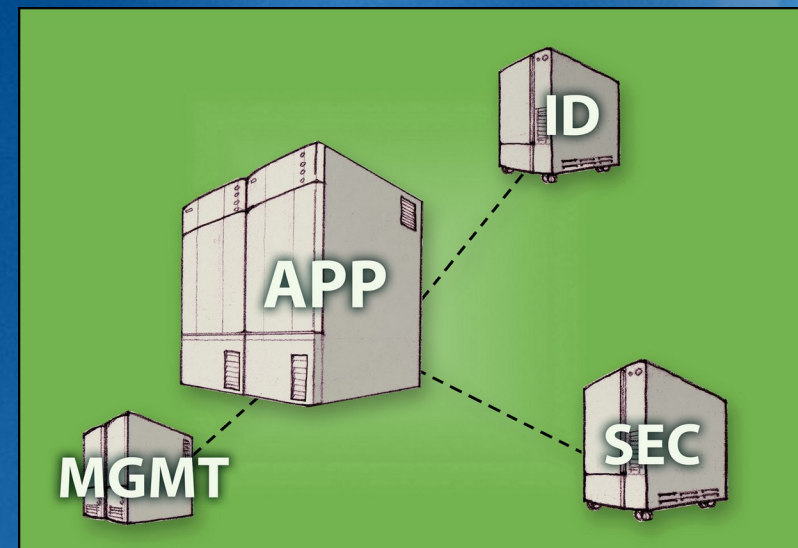


See: “IT Doesn’t Matter - Business Processes Do”
by Howard Smith and Peter Fingar,
Meghan-Kiffer Press, 2003

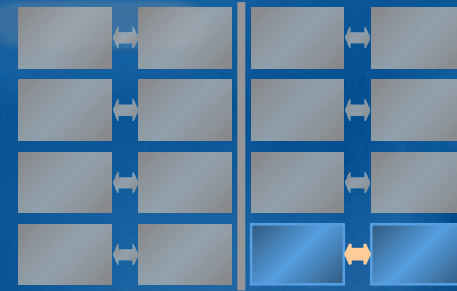
Empowering IT Infrastructure



- **IT Infrastructure Is New and Growing**
 - Cope with Many Different Machines...
- **Connect IT-Wide Services with App Services**
 - Coordinate with IT-Wide Services
 - Tap Into the App Services
- **“Services” Technology Allows Connection!**
 - Empowers Tapping In
 - Will Get Easier...
- **Federated Infrastructure**
 - Identity, Security, Mgmt, Monitoring, Naming, etc
 - Stuff We Haven’t Thought of Yet



Empowering IT Governance



- **IT Governance Is Usually a Pendulum**
 - Swing to Centralized Control to Rein in Costs
 - Biz-Units Complain about Pace of App Delivery
 - Swing to Decentralized Control to Gain Function
 - Chaotic Growth of Apps Becomes Overwhelming
- **“Services” Empower a Balance**
 - Can Decentralize While Constraining Integration
 - Must Tap into Infrastructure
 - Must Tap into Biz-Process
 - Resource Management Separate from Biz-Process



Outline

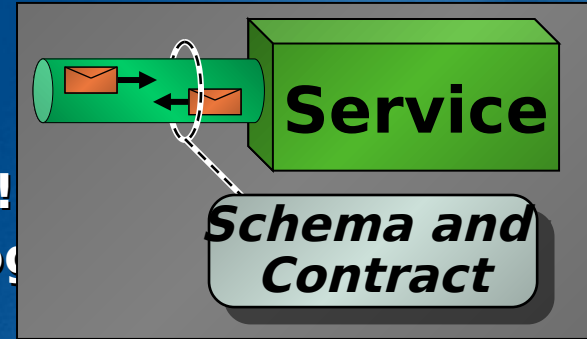
- **Metropolis: The Analogy**
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Implications Of Metropolis

- **Heterogeneity Happens!**
- **Ongoing IT Investment**
 - **Infrastructure versus Business**
 - **Historic Monuments**
- **Standardization Is Nascent**
 - **Connection Largely by People**
 - **Efficiencies Still to Come**
- **Business Process Is Nascent**
 - **Still Mostly Ad-hoc**
 - **Growing to Become Dominant Force**
- **Loose Coupling Helps Investments**

Envisioning The Service-Oriented Enterprise

- **Services Move Us Forward**
 - Lots of Islands of App Code
 - Services Are for Connecting the Islands!
 - Complements Object-Oriented Technology
- **Independence Is Essential**
 - Services Evolve Independently
 - Build versus Buy
- **Inside Your Company and Across Companies**
 - EAI: Enterprise Application Integration
 - B2B: Business to Business
 - It's All About HST!
- **Services Cleave Your Applications**
 - They Cleave Them Apart Into Independent Pieces
 - They Cleave Them Together Allowing Interaction



And Now, A Word From Our Sponsor...

- **There's Some Cool Technology Coming!**
 - **Web Services**
 - Industry Agreed Upon Interoperability Standards
 - **Indigo**
 - .NET Technologies for Building and Managing Service-Oriented Systems
 - **BizTalk**
 - Message Transformation and Orchestration
 - **Yukon SQL Service Broker**
 - Integrated Messaging into Databases
 - Automatic Support for Conversational Messaging
 - Transaction Protected Reliable Messaging
- **Keep an Eye on This Technology!**

Build Your Services Now!

- **You Will Be Building and Connecting Services**

- **The Economics Force:**

- Pieces of Application (Services)
- Connected by Messaging

- **You Can Build Service Now!**

- **Look for “Low-Hanging Fruit”**

- Find Where You Can Save Money for Small Investments
- Be Pragmatic

- **It'll Be Easier with Longhorn but Don't Wait!**

- **The Sooner You Get Started, the More You Gain!**

- **Guidance Available to Help:**

- <http://msdn.microsoft.com/architecture>
- <http://blogs.msdn.com/PatHelland> -- Pat's Blog Full of Miscellany



Architecture Track Changes

- **ARC 302 changes to Metropolis Discussion**
 - Discuss this sessions' content and drill into the relationship between applications and buildings
 - 5pm in Room 7AB (Misprinted in Guide)
- **ARC 303 Canceled**
 - Replaced with WINC05+
- **New Speaker for ARC C06**
 - Presented by Gurpreet Pall, Director, Microsoft Architecture Strategy
 - Expert in MSA and Infrastructure Architecture

Community Resources

Attend a free chat or web cast

http://www.microsoft.com/communities/chats/default.mspx_

http://www.microsoft.com/usa/webcasts/default.asp_

List of newsgroups

http://communities2.microsoft.com/_

communities/newsgroups/en-us/default.aspx_

MS Community Sites

http://www.microsoft.com/communities/default.mspx_

Locate Local User Groups

http://www.microsoft.com/communities/usergroups/default.mspx_

Community sites

http://www.microsoft.com/communities/related/default.mspx_

Session Evaluation

Please fill out a session evaluation on CommNet

Q1: Overall satisfaction with the session

Q2: Usefulness of the information

Q3: Presenter's knowledge of the subject

Q4: Presenter's presentation skills

Q5: Effectiveness of the presentation

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